Lamésche, Mathieusche und verwandte Funktionen in Physik und Technik. By M. J. O. Strutt. Pp. viii, 116. RM. 13.60. Ergebnisse der Mathematik und ihrer Grenzgebiete, Band I, Heft 3. 1932. (Julius Springer)

The book deals with the functions arising from consideration of the wave-equation, $(\nabla^2+k^2)\,u=0$, in elliptical and in ellipsoidal coordinates. The former leads to Mathieu functions; the latter, with $k^2=0$, to what are usually called Lamé functions. The author calls them Lamé potential functions, and uses the term Lamé wave-functions for the functions arising when $k^2\neq 0$. (The ordinary differential equations of which the functions are solutions, especially the Mathieu equation, arise also from consideration of several physical problems unconnected with the general wave-equation.)

Adequate accounts of Lamé potential functions have been given elsewhere. Previous connected accounts of Mathieu functions, such as that in the last edition of Whittaker and Watson's *Modern Analysis*, are, however, out of date; and there is no connected account of Lamé wave-functions. There is, then, a gap to be filled, and to some extent the work before us serves this purpose. It is a useful book, both for pure mathematicians interested in the theory of special functions, and for applied mathematicians compelled to use the functions in their researches. It is worthy of consultation by both classes, but it is rather superficial, and there is no pretension to a complete treatise, so that it is doubtful if anyone will find here all that he requires without recourse to further literature. This, too, may be unsuccessful in many cases, for there is a vast amount of unexplored territory. Despite moderately substantial recent advances in the theory and computation of Mathieu functions, much that we should like to know is still hidden, whilst our knowledge of Lamé wave-functions is still exceedingly meagre. Indeed, the account of these functions in this book relates almost entirely to formulae valid only when the k^2 of the wave-equation is small.

Although a fairly representative account of some of the rather pedestrian methods which have so far proved most fruitful may be found in the brochure, nevertheless there are significant omissions. There is no account of integral equations, and space might profitably have been devoted to a short account of the method recently employed by Whittaker to find recurrence formulae for the Mathieu functions. The applied mathematician should be warned that he will find no tables, since even such tables as have been published have not been reproduced. Again, the zeros of the functions, so important in many physical investigations, have not been discussed, although the zeros of the Mathieu functions, for example, have been studied by Jeffreys, Ince, Hille and Goldstein.

On p. 37 the author quotes the asymptotic formula for the characteristic numbers of the Mathieu equation from my paper in the *Transactions of the Cambridge Philosophical Society*. The last term given was wrong, and the corrected formula was given in a paper of mine in the *Proceedings of the Royal Society of Edinburgh*. The author refers, indeed, to this last paper, but quotes the uncorrected formula nevertheless. Nor does he give the main result of this last paper—an asymptotic expression for the difference of two neighbouring characteristic numbers, use of which I should strongly recommend to anyone who wishes to do any computation in connection with the Mathieu equation.

The book closes with a section on physical applications. The mathematical problems are formulated, and formal solutions are given, but no numerical results. The value of this section is doubtful, since anyone who wishes to study the physical applications could probably formulate the problem and write down the formal solution for himself.

The book is issued in paper covers, and is very expensive.

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